Arbor and Wild Life Day

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THE UNIVERSITY OF THE STATE OF NEW YORK

BULLETIN TO THE SCHOOLS

VOLUME 40 FEBRUARY 1954 NUMBER 6

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The Arbor and Wild Life Day number of the BULLETIN is the only one devoted annually to natural history and conservation interests.

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COVER PICTURE: The Mountain Lion
From a painting by Ralph S. Palmer

THE UNIVERSITY OF THE STATE OF NEW YORK
BULLETIN TO THE SCHOOLS

Issued monthly during the school year by the State Education Department

CHARLES F. PROBES, *Editor*

This bulletin is sent without charge to all schools and educational institutions of the State. To others it will be mailed postpaid for $1 a year, 10 cents for single copies.

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The University of the State of New York

Bulletin to the Schools

VOLUME 40 FEBRUARY 1954 NUMBER 6

Arbor and Wild Life Day

OUR COUNTRY WAS ONCE SO RICHLY ENDOWED WITH VAST FORESTS THAT more than two hundred years were to pass before any organized movement to save a tree or to plant one was to gain attention. Indeed, so urgent was the need of our first settlers for open space and farms that they felt an actual enmity to the huge trees so hard to fall, barring the sunlight from their patch of corn.

It was not until 1872 that a day came to be set aside for the public planting of trees. All of us in the schools today, whether students or teachers, associate Arbor Day with pleasant memories. Many of us recall events of a very special nature featuring the day in our own school experience. Perhaps it meant a picnic in the woods, or an outing combined with the work in which each of us imagined he was another Johnny Appleseed as we bent over with trowel and seedling.

The painter Grant Wood tells the story as many of us remember it — a small one-room school standing stark against undulating fields and a far skyline — winter has but recently passed — the roads are still deeply rutted — a teacher and her pupils of varying size gather about a newly dug hole where the tree which will one day shade the school yard is lowered in and firmly planted by two of the larger boys, while a third pumps a pail of water at the nearby well.

Arbor Day 1954 is different. Most of our schools are larger now; many of you will not be within easy walking distance of fields or woods. It is all the more important, therefore, that our young people learn early the wealth of a tree, the importance of wild life, the values of conservation. Arbor and Wild Life Day offers a splendid opportunity to call attention again to the ideals and traditions of our great Nation. Through it we can make contribution to the future strength of our country and stress again the great blessings which have been given in such abundance to our beloved land. Our courses in conservation and nature study, citizenship education and general science are a natural extension of Arbor Day's lessons for the year around.

Now, therefore, by virtue of my office as Commissioner of Education, and in accordance with the law, it is my privilege to designate April 9th as Bird Day, and April 30th, May 7th or May 14th, whichever best suits the convenience of each locality, as Arbor and Wild Life Day.

Lewis A. Wilson

Commissioner of Education

This Was the Forest Primeval

As Revealed by Pollen Analyses and Writings of Early Travelers and Surveyors

RALPH H. SMITH
Game Research Investigator
New York State Conservation Department

IN 1609, WHEN HENRY HUDSON SAILED up the great estuary that now bears his name, he found everywhere the seemingly unbroken green mass of the forest. The Dutch traders and settlers who followed him and pushed inland confirmed this impression, for they found the forest expanse broken only by lakes, ponds and streams, by the few Indian clearings and the trails that connected them. It was of this ancient woodland that Longfellow was reminiscing in 1847, when he set down the prelude to "Evangeline,"

> This is the forest primeval. The murmuring pines and the hemlocks,
> Bearded with moss, and in garments green, indistinct in the twilight...

Reminisce he well might, for the forests he had known as a boy in Maine had virtually disappeared. What do we know about the forest primeval in New York, how primitive and how permanent was it before our ancestors changed it so drastically?

The written records are all too few. Our best descriptions have come from the writings of botanists like Peter Kalm, who traveled to Canada and back by the Hudson and Champlain valleys in 1749. John Bartram, Pennsylvania Quaker, farmer, traveler and self-taught naturalist, visited parts of New York in 1741, 1742, 1743 and 1753 and wrote of what he saw, commenting on how rapidly the forest was being reduced to cultivated fields. Land speculators like Richard Smith of New Jersey kept diaries of their observations, while travelers like Timothy Dwight, president of Yale College, recorded the speed with which trees disappeared and farms and settlements arose between his visits.

For the composition of the forest itself and some indication of sizes, one reliable source is the field books of the land surveyors. The surveyors generally were required by their employers to keep a record of the principal species of trees observed along the survey lines and to record carefully the location of each corner by describing the kind of stake used and the nearby trees blazed as "witnesses." Some rated the appearance and growth of the timber, the appearance of the soil, and classified the land as to the crops that might be grown thereon.

Some evidence as to the nature of the prehistoric forests is being pieced together from analysis of plant pollens preserved in bogs. These deposits are now being dated by the recently developed radioactive carbon method. While pollen deposits in bogs are generally supposed to reflect conditions in the immediate vicinity of the bogs, they do indicate the general forest conditions which in turn are a reflection of the prevailing climate.

If we may rely on the pollen deposits, the disappearance of the Pleistocene ice sheet was followed by a cold period in which white spruce and balsam fir were predominant. A warmer, drier period followed in which pines, chiefly jack pine,

were more numerous. The next period was more moist, with the appearance of oaks and hemlocks, giving way in turn to oaks and pines in what must have been a warm dry climate. It is believed that during this time many plants, whose centers of distribution today lie to the west and south, became established in our area. A number of these, like the grasses of the prairies, survive here today as relicts only on very dry sites. In recent times the climate has become cooler and more moist, favoring the predominance of beech, maple and hemlock over much of the State.

At the time of the arrival of the first Europeans in the seventeenth century, the greater part of our State was covered by hardwood, or deciduous, forest. Oaks covered most of Long Island but in the western part of the island the settlers found the grasslands, known as the Big and Little Plains, in which bluestem grass was predominant. In 1644, settlers from Connecticut founded Hempstead at the south edge of the Big Plains, hoping to use the cleared ground for crops, and also to have firewood near at hand. They soon learned, however, that the grassland soils were so dry in late summer that their crops would fail. The grassland of the Big Plains was thereafter held as a common grazing land, subject to colonial laws regulating its use and forbidding setting fire to the grass. It remained undivided until 1869, when the first substantial area was sold to real estate promoters; small portions lay uncultivated until as late as 1947, when they were obliterated by housing developments.

To the east lay the "brushy plains" in what is now Suffolk county, in which pitch pine and the scrub oaks predominated. These soils were not so droughty, hence the open nature of these woodlands was maintained by frequent fires, to which the pitch pine and the oaks were the most resistant.

Photograph by A. L. Hough

Old-growth White Pine Towering above Its Associates

The oak-chestnut forest extended north up the Hudson valley to the vicinity of Glens Falls and Lake George. Pine barrens similar to those of Long Island occurred on the dune sands between Albany and Schenectady and northward to Glens Falls. Oak-chestnut forest occurred elsewhere on the hot, dry, south-facing slopes of the lower Delaware valley and the Southern Tier valleys.

The lower slopes of the Catskills, the Taconics and the Southern Tier hills were covered with a forest of beech, sugar maple, black cherry, basswood and hemlock, often with an admixture of white pine, indicating disturbance in the forest which had permitted the pines to seed in thickly. In the Lake Plains, the predominating species were maple, basswood, beech and black birch, with hemlocks limited to the damp ravines and swamps. The latter were numerous, clothed with black ash, elm, red maple, alder, willow and hemlock. Extensive areas of cattail marsh occurred, and still remain, in Oak Orchard swamp and the Montezuma marshes. Such well-drained sites as the sands of the buried stream valleys and the thin soils over limestone outcrops were covered with oak-chestnut or oak-hickory forest, as in the Genesee valley, but these were isolated islands in the sea of beech and maple.

The higher elevations of the Catskill mountains, the northern Taconics, the Tug Hill and the periphery of the Adirondacks were forested with beech, yellow birch, hemlock, red spruce and balsam fir. The swamps and higher elevations of the Adirondacks were covered primarily with spruce and fir, while the very highest Adirondack peaks bore either dwarfed forests of spruce, fir and paper birch or dwarf willows, birches, blueberries and a number of plants found elsewhere in the sub-Arctic barrens to the far north.

Photograph by Walter B. Starr

Repeated Fires Created These Dry Open Barrens of Pitch Pine and Scrub Oaks

On the sands of the Black River valley and the sands east of the Adirondacks were extensive areas of white pine. The latter area even today remains as an important white pine area, on which white pine is able to succeed itself without substantial disturbance of the soil. It was the great size of the white pines that excited the admiration of the viewers, for the old trees stood far above the tops of the hardwoods. Timothy Dwight, visiting Meredith in Delaware county in 1804, described one such stand:

> The hill, which limits the Northern prospect, is covered with a magnificent growth of white pines; one of which, having fallen down, was measured by Mr Law, and was found to be two hundred and forty-seven feet in length. This cluster is the only considerable one, composed of full grown trees of this kind, which I have seen. . . It is not improbable, that the next generation may never see a white pine of the full size. . .

Courtesy of Connecticut Agricultural Experiment Station

Native Chestnut Photographed in 1905. The Deadly Chestnut Blight Has Since Killed All of Them to the Ground.

The primitive forest was a place of change, generally slow but sometimes very rapid indeed. Long-term changes in climate altered the species composition of the forest from those favored by cool moist climates to the oaks and pines whose reproduction was favored by warm dry periods. The continued existence of oaks and pines in many upstate situations has depended on very dry sites and the frequent recurrence of fire, which created dry conditions to which the oaks and pines have proved more resistant than other species like beech and maple. The ability to sprout anew after being killed to the ground likewise permitted the oaks to persist.

Old age with the stagnation of growth resulting in decay and death of trees was a steady source of change. Insects and fungous diseases hastened this change and sometimes brought about sudden alterations in the forest. Even more dramatic were the effects of strong winds. One such windstorm, in 1845, shattered a path half a mile wide and more than ten miles long across southern St Lawrence county. Only too fresh in our memories are the effects of the hurricanes, like those of September 1938 which demolished the forests of southern New England, of September 1944 which touched the Adirondacks and of November 1950 which hit the Adirondack forest in earnest and created a wild nightmarish tangle of shattered uprooted trees over vast areas. It is easy to imagine how a single lightning-set fire in this tinderbox could set back the forest 100 years or more.

Fungous diseases are doubtless of more importance in creating changes in the forest today, because man unwittingly transports them from regions where they have established a balance of sorts with the tree growth to our own area where our native species have little or no resistance to the fungous invasions. Chest-

nut blight, which probably was introduced about 1900 from eastern Asia, has reduced our native chestnut from a valuable source of timber, posts for fencing and nuts to feed small boys and squirrels, to a scattering of stump sprouts. White pine blister rust, which did little harm when it was restricted to the five-needled pines native to Europe, has not been quite so devastating in this country because it can be halted by the removal of currants and gooseberries on which the fungus must live part of its life cycle. Oak wilt, which could wipe out all the oak trees, the so-called "Dutch" elm disease which probably originated in Asia, as well as the others mentioned, may well have had their counterparts in prehistoric times to change the forest composition.

Fire was an important cause of change in the primeval forest. Lightning still is an occasional source of forest fires, especially during the dry seasons. Fires so created may spread immediately or burn for weeks in the forest duff until strong winds cause them to burst into flames. The drier sites burn more readily but a dry coniferous forest is almost explosive when set on fire. Such hot fires may remove all the organic matter, leaving a mineral soil material that may not be reforested naturally in 50 to 100 years. Such conflagrations on the drier hardwood sites permitted such species as white pine and red pine to maintain them-

Courtesy of Connecticut Agricultural Experiment Station

White Pine Seedlings. White Pine Often Seeds Naturally into Abandoned Fields, Thus Increasing Its Distribution.

selves long after the climate became moist enough for the hardwoods to seed densely and crowd out the pines.

Lacking metallic tools, the Indians found fire could be used to kill trees and brush on the sites of their agricultural clearings. Fire removed the dried weeds from their gardens in the spring. It was also used to open up the woods about their settlements, to encourage the growth of grass and herbs to attract game, and to render it difficult for enemies to take the settlement by surprise. A ring of fire surrounding several square miles of woodland was used to drive game, thus making hunting easier.

Areas repeatedly burned in this manner tended to remain more or less open for long periods of time. Most of the clearings, like the famous "oak openings" in central and western New York found by the first European explorers and settlers, originated in this manner. The Indians themselves tended to restrict their settlements to the oak-chestnut and oak-hickory forest because it could be burned over readily each year or so, because the sites were drier under foot the year round and because the forest trees themselves yielded seed crops on which both game and the Indians could subsist.

The first settlements by whites were limited to the lower and middle Hudson valleys where water transportation was easy. Land clearing was dependent to a great extent upon the use of fire for tree removal, even though the farmers had axes to cut down the trees. This was sometimes impossible to do legally, since all good white pine trees were to be saved for shipmasts for the English navy.

In spite of the prohibitions, the settlers continued to use fire to get the trees out of the way. While the rate was rapid enough before the Revolution, after 1783 land clearing progressed at an even greater rate; by 1880 the untouched forest was confined to a few remote spots in the Adirondacks. Much of the indignation over the treatment of the Adirondack forests in the late 1800's stemmed from the effects of fires after the lumbering operations, then employed, had left a jumbled mass of highly inflammable treetops and branches. While legal requirements for disposing safely of this unusable material have changed drastically, the memory of the nineteenth century lumbering methods still lays a heavy hand on proposals to practice scientific forestry on state-owned lands in the Forest Preserve.

Abandonment of cleared land started almost as soon as it was cleared, for some soils were so poor that in only a few years the fertility was gone. Until the 1880's clearing outpaced abandonment but since that time the ratio has been reversed. Several million acres of land that should have remained in forest have been abandoned. Planting of these lands, not with hardwoods which are difficult to establish satisfactorily but with conifers like the pines and the spruces which do better on the impoverished soils, has hastened their reversion to forest by many years.

Certainly not all the primitive forest was composed of pines 200 feet or more tall such as Timothy Dwight described. The surveyors' records showed much forest blown down, deadened by fire, injured by frequent ice storms or replaced by shrubby growth, indicating that first quality timber was not the predominant class.

What the future may bring is speculative. Our utilization of wood and the inexorable demand of taxes at present prohibit setting aside any considerable amount of private forest for the next 400 years. Only on public lands like the Forest Preserve will it be possible to try to regain even small samples of the forest primeval.

Climbing Fern (*Lygodium palmatum*)

Bird's-foot Violet (*Viola pedata*)

Have you seen these growing in New York?

Orange Milkwort (*Polygala*

Swamp Pink (*Sabatia dodecandra*)

Sweet Bay (*Magnolia virginiana*)

Where Are They?

Wanted: 199 Missing Plants

STANLEY J. SMITH
Senior Curator of Botany
New York State Museum

SINCE THE BEGINNING OF COLONIZATION of the area now known as New York State, innumerable observations have been made on the plants growing within our borders. The New York State Museum has a file of distribution maps, now totaling well over 3500, for all species and subspecies of seed-plants, ferns and "fern-allies" which have been reported for the State. The author is now engaged in a search for those particular native types which have not recently been seen in New York State. A preliminary listing of those needing investigation gave the following statistics:

Plants not seen for over 100 years.....	8
Plants not seen for over 75 years.....	21
Plants not seen for over 50 years.....	66
Plants not seen for over 25 years.....	199

In a few cases the original report was doubtless erroneous. In other instances there are almost certainly specimens to be found in collections of institutions other than the State Museum, as well as in those of private individuals. For instance, L. A. Ellison, an avid field botanist, reports to me that he found a moss-like species of the heather family with bell-like flowers (*Cassiope hypnoides*) on Mount Marcy in 1929. Our last previous record was for 1879. For many other plants, there is field work to be done; certain species once known from relatively inaccessible areas are still found, after diligent search, to occur there. It is planned to reduce this list to a minimum and then to analyze the reasons for the disappearance of each kind of plant from our environment.

Let us consider the eight species which have not been seen in the State for over 100 years. Of these eight, two are small-flowered aquatics, one a grass, one a shrub; and the remaining four belong to the category more popularly known as "flowers," that is, herbs with showy flowers. The chinquapin (*Castanea pumila*), a shrub chestnut, reportedly occurred on western Long Island in the early days. This was already extinct by 1843, the year the first state flora was published. It presumably was destroyed by the activities of European civilization in what is now Brooklyn. One of the flowering types, three-flowered avens (*Geum triflorum*), a member of the rose family, occurred along the Black river in what is now the city of Watertown. Another, Virginia mallow (*Kosteletzkya virginica*), was found in the salt marshes near Oyster Bay. All eight species concerned were known from but a single station each, with the lone exception of the chinquapin, which had apparently been found in a local area of larger extent. All were at the edge of their ranges. Their localized occurrence obviously made these species more vulnerable to extirpation and the distribution of the main mass of each species made natural reintroduction more difficult than would be the case with commoner kinds.

Of the remaining 191 kinds, three are ferns, one is a conifer and the remainder are flowering plants. Among these latter are some very showy species. Records for the flame azalea (*Rhododendron calendulaceum*) are vague, but an early

report of an azalea with yellow flowers (from near Newburgh) would seem to be it. Has it been lost to our native flora and, if so, why? Two of the four handsome rose-flowered swamp pinks or bitterblooms (*Sabatia spp.*) occurring on Long Island seem to be lost. Neither of the brilliantly orange puccoons (*Lithospermum spp.*) has been seen for over 50 years. Does the sweet bay (*Magnolia virginiana*) still occur as a native on Long Island or has it become extirpated in the State? Have we lost the two northerners, the bakeapple or cloudberry (*Rubus chamaemorus*), an herbaceous amber-fruited "bramble," and the Arctic silverweed (*Potentilla egedii*) from their stations on outer Long Island?

A few more cases may be mentioned. A member of the waterleaf family (*Phacelia dubia*) was found in abundance near Syracuse from 1902–4. Since the closest localities, elsewhere, were in southern Pennsylvania, one might assume it was a weedy introduction, but there is a specimen in the State Herbarium labeled "western New York, 1830." Was it destroyed by industrial ventures?

The beautiful climbing fern (*Lygodium palmatum*) was found at Hunter, Greene county, in 1874. It was gone in 1876, reportedly because of vandalism. A station located near Greene, Chenango county, was apparently destroyed by a flood. Recently the species has been discovered in Saratoga and Onondaga counties. At least one of these sites is in danger of destruction by clearing of the land. The pretty little fairy-slipper orchid (*Calypso bulbosa*) has been sought without avail by many botanists. This year it has been reported as still occurring locally in Genesee county.

Can we maintain representatives of these and other members of our original native flora for posterity? This research project is important from a conservation standpoint. If we can determine why these missing plants disappeared, we may be able to prevent the loss of other rarities.

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Convocation To Stress Resources

As part of the two-day Convocation program of the Board of Regents, a symposium on "Our Material and Human Resources: a Basis for Educational Planning" will be held Thursday, April 8th, at 2 p. m., in the Assembly Chamber of the State Capitol. Speakers will include Dr Paul B. Sears, chairman of the Conservation Program of Yale University; Dr Fairfield Osborn, president of the New York Zoological Society; and Dr Dael L. Wolfle, director of the Commission on Human Resources and Advanced Training.

A series of 20 special exhibits on the theme "Man Must Understand His Environment" will be placed on display in the State Museum. Planned by the various sections of the State Museum and State Science Service, these exhibits will tell the story of changes in the natural environment from the geologic past to the present. Successive panels will depict man's efforts to achieve some degree of control over his environment. Six other displays will illustrate the importance of biologic interdependence and a third series will summarize research studies conducted through the years by the State Museum and State Science Service. Several preview showings of new natural history films will also be given.

Why Birds Sing

Bird Song Is Usually Seasonal and Serves Many Purposes

PETER PAUL KELLOGG
Laboratory of Ornithology
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Cornell University

WHAT A STRANGE WORLD THIS WOULD be if human beings made no sounds. Most of the friendly greetings for which we now use our voices would be given by sign language or in writing — if at all. It would be a dull and perhaps a very ignorant world, since we would be without our quickest and easiest means of transferring ideas and other intelligence.

Vocal utterances of birds must also serve them in many ways, and while many of the uses to which birds put their voices are familiar to us, others are strange. Let us consider some of these ways in which birds use their voices.

First, we should realize that birds do many more things by instinct than most people do. Songs of birds, or their call notes, seem to be a part of the species inheritance. An oriole raised away from all other orioles will still sing and call like an oriole but the patterns in which he puts his notes together may be very different. Last year in Canada just north of our St Lawrence River border there was a Baltimore oriole which sang over and over again the first seven notes of the tune "Yankee-Doodle." I never had heard another oriole sing this way before; yet the song was easily recognizable because of the quality of voice common to all Baltimore orioles.

Who sings and when? With birds, it is often the male which does all the singing but that is only a general statement and usually applies only to the song and not to call notes. In our collection of bird songs in the Laboratory of Ornithology at Cornell, we have some recordings of the female oriole which rival the male. But song is usually a seasonal phenomenon. Robins winter as far south as Florida but they almost never sing there, and although a few robins stay with us in New York State all winter, we never hear them sing until the warm days of spring. From this, and from the fact that birds sing best just when nesting activities are about to begin, we surmise that song is somehow connected with mating activities.

Photograph by A. A. Allen

Mockingbird Defends Territory by Singing, Trying To Combat His Own Recorded Voice Coming from Loudspeaker

Photograph by A. A. Allen

Swamp Sparrow Singing from a Typical Perch

In human society it is not unusual for a lover to serenade his loved one. It is quite possible that birds use song for this same purpose and it has actually been shown that the heart of a female bird beat faster each time her mate sang. It has also been observed that a female redwing, busy at nest building, stopped work each time her mate sang and a little quiver seemed to run through her body. But this is far from being the only use of bird song by birds.

Birds, as well as most human beings, like to "stake out" and claim a bit of the earth as their very own territory. Like people, some birds lay claim to great areas while others are satisfied with very little space. A kingfisher may claim as much as a mile of territory up and down a watercourse, while a purple martin will be satisfied with an apartment in a martin house. Within these territories the claimant, usually the male, will try to drive out any invader of the same species, although at breeding time he permits the female to share the area with him.

Song plays an important part in the defense of territory. Many persons think that this is the most important use of bird song. The male bird spends much of his time on a song perch in the middle of the area, or going about the area, singing. Song thus serves to announce the male bird's presence and to warn other birds that the territory is occupied. If there are very few other birds of the species about, song is likely to be infrequent, but if the area is so crowded that there is heavy competition, song is likely to be almost incessant and much fighting may take place. Sometimes, when the competition is heavy, song serves as a battle cry and often after a heavy engagement the fighting males will fly to a limb and sing their loudest before they clash again. Sometimes they will even clash while singing.

Since the male birds often arrive on the nesting grounds ahead of the females, it seems obvious that the song of the male may serve to attract the female to the territory, but it is very difficult to separate this use of song from that of defending territory.

All birds do not have songs — or at least their sounds are not expressed vocally. Perhaps we should call these performances substitutes for song. The male ruffed grouse snaps his wings through the air with a forward and upward motion, making a dull resonant thump usually referred to as drumming. There are about 50 of these thumps in a drum; they start out so slowly that you can easily count them, but the speed increases until, at the end of the drum, the thumps come so close together that our ear hears them only as a dull roar resembling the sound of an airplane propeller. This substitute for song seems to fill the purpose very well, as it probably attracts

the female grouse and also declares the location of his territory.

This drumming of the grouse is interesting in what might be called a passive use of bird sounds by predatory animals. I imagine that nothing would suit a great horned owl better than to hear a grouse drumming in the woods and then have only to follow the sound to get a good meal. If this were possible, drumming would be a hazardous activity for a grouse to engage in, but experiments in the Laboratory of Ornithology at Cornell indicate that a great horned owl has very deficient hearing in the frequency range covered by the drumming of the grouse. If this is true, we have an exhibition of another of nature's remarkable adjustments.

Frequently in the spring we receive a call from an irate householder that a woodpecker, usually a flicker, has chosen a tin roof or a ventilator on the house for creating a terrible din — and at 5 o'clock in the morning. What can the bird possibly hope to find to eat inside of a metal ventilator even should he be able to drill through? Actually, this is just another example of a substitute for song. But what to do about it is quite another matter. The flicker considers this a part of his territory and he apparently wants all the world to know about it — regardless of the hour. Sometimes it takes much ingenuity to solve a problem like this, as most of our birds are protected by law.

The call notes of birds serve many purposes but mostly they can be classified as communications. Dr Nicholas Collias has made several studies which I like to think of as delving into the language of birds. Who has ever worked with chickens without learning the call which indicated that there was a hawk or other danger nearby? Or the call of the hen which indicated that she had found some succulent tidbit for the chicks? In a study of chicken calls, Doctor Collias noted that sounds associated with pleasure, such as food or contentment, were ascending sounds while sounds indicating danger, fear or anger went down the scale.

This past year Doctor Collias and I recorded many of the songs and calls of the goldfinch. It appeared that the female bird on the nest had a call of greeting and that the call was slightly different when her mate flew over than it was when another male or a female flew by. Notes — I would almost like to call them words — were used when the male was returning with food, and these were different notes from those used when he returned with no food. Another note, or word, in the goldfinch vocabulary caused the young birds to shrink down into the nest and remain absolutely quiet when danger threatened.

One of the young goldfinches was brought into the house, where his lan-

Photograph by E. G. Allen

Professors P. P. Kellogg and A. A. Allen Recording Flight Song of the Woodcock

guage and response to bird and human language were studied further. Doctor and Mrs Collias noted that this goldfinch appeared to enjoy their company. When left alone in a room he would often give a call which almost certainly indicated that he was lonesome but when a person entered the room, the "lonesome call" would stop and often be replaced by a call which seemed to mean contentment.

Calls which indicate fear or trouble are often used by young birds and have an almost irresistible attraction to adult birds, especially during the nesting season. It is quite easy to imitate approximately this squeaky fear call by loudly kissing the palm or back of the hand. It is a worth-while trick to learn and often brings a bird out of the thickest brush to see what the trouble is. I have had a sharp-shinned hawk swoop within a foot of my face in response to my squeaking, apparently recognizing the call as trouble in the bird world which might result in a good meal for him.

Many birds have warning calls, and any goose hunter can tell you of an alarm note often given by one of these birds which will cause every goose on a field to raise its head and become alert for danger. Robins have a call which seems almost to say "cat."

Hunger calls and calls which serve to disclose the location of a young bird to its parents or others of its kind are found in most species. With gregarious forms such as the bob-white quail, these location calls are very well developed and serve to keep the flock together.

The esthetic possibilities of bird song should also be mentioned. I say possibilities, because many would argue that a beautiful bird song is only an automatic response to the environment. I believe we can subscribe to this theory and still rightly attribute to some birds, at some times, an esthetic sense.

When a wood thrush, a hermit thrush or a robin sings in the quiet of a beautiful spring evening, there often seems to me to be no way of explaining the beautiful quality of his song other than that he is giving expression to a feeling of pure joy. For the moment nothing else matters but that he express his ecstasy by producing his most beautiful music.

NOTE. The authentic songs of hundreds of birds have been recorded by Professors P. P. Kellogg and A. A. Allen and their associates of the Laboratory of Ornithology at Cornell University for the Albert R. Brand Bird Song Foundation. For further information on the two albums of American Bird Songs, as well as their other recordings, write to Comstock Publishing Associates, 122 Roberts place, Ithaca.

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Acknowledgment

This Arbor and Wild Life Day number of the BULLETIN TO THE SCHOOLS was compiled with the cooperation of the New York State Museum. The editor desires to express his appreciation to Myrtice A. Blatchley, museum education supervisor, and to all who contributed articles and photographs.

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Cover Leaflets Available

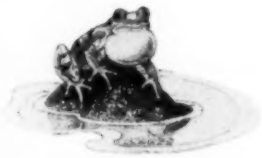
Single copies of the colored cover picture of the mountain lion, with descriptive account, are available in leaflet form from the Education Office of the New York State Museum, Albany.

Flying Shadows

DOROTHY P. LATHROP

[Abridged from Dorothy P. Lathrop's book, *Hide and Go Seek,* and reproduced by courtesy of the author and the Macmillan Company.]

Illustrations are by the author.



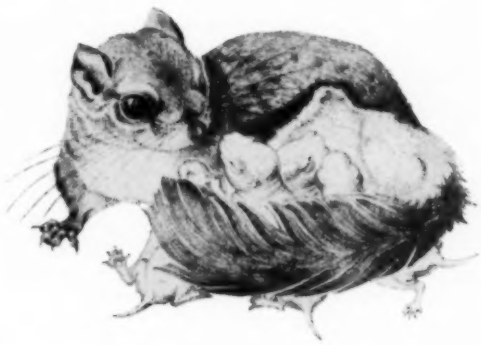
EVENING WAS COMING. The last sunlight lay flat along the floor of the woods. And at the edge of the pond, tiny spring peepers were already puffing out their throats into white bubbles and sending their sweet, shrill call through the woods.

For it was still April. Ferns pushed tightly curled heads up out of the ground. And spring beauties opened frail petals where budding leaves cast no shade. Had Spring come?

Chipmunks popped out of their holes to see. Perhaps, even down in their deep burrows, the singing of the peepers had waked them from their light sleep.

Was that a gray squirrel's hole far up the trunk of that tree?

No, for as suddenly as a wooden cuckoo bobs out of his clock and in again, so quickly did a little head appear from the hole's blackness, gaze silently down into the growing darkness — and was gone.



It wasn't a gray squirrel, with head so small. Nor a chipmunk, with nose so blunt and eyes so enormous. It was a flying squirrel, and in a nest at the bottom of the hole were her four babies.

They weren't nearly as pretty as she was. They

were blind, and pink, and perfectly naked, but she was very proud of them. She had had them only three days.

Blindly they nuzzled close to her as she lay down and spread herself over them like a soft, warm blanket.

Day after day went by and the woods were warm and bright with sun.

The gray squirrel lay flat along a limb, warming his back. Red ones frisked through the barest, sunniest branches. And when it was hottest, chipmunks sat toasting their stripes, and little dusty snakes crawled out of the ground and basked on sun warmed rocks.

Every day the four tiny squirrels were growing bigger.

But even when they were ten days old, they couldn't see a bit more than on the day they were born.

Their heavy heads wobbled when they tried to walk. Their legs wobbled too, and they sprawled flat on their tight little stomachs with webs outspread as if already they longed to sail through space. And over their pink backs was creeping a dark sheen of fur.

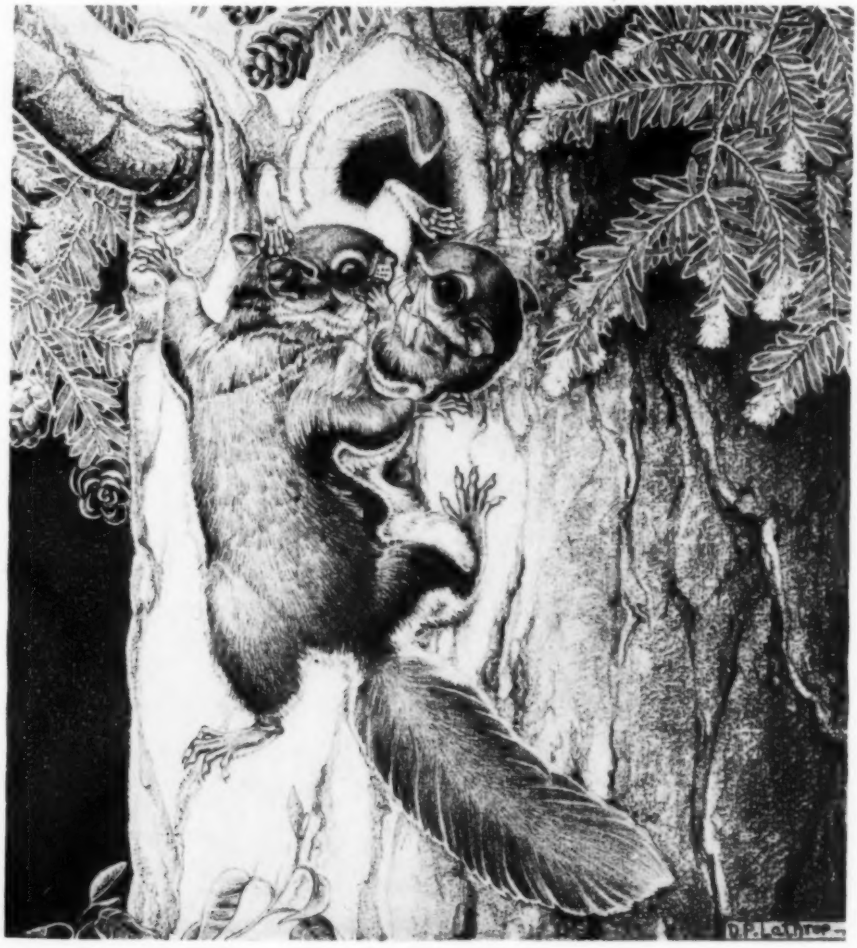
A few more days and their whiskers sprouted. Could such stubs ever grow long like their mother's? And their tails, which had been so short they stuck out straight, sprouted, too, and curved downward.

Then the little squirrels grew so fast they stretched the wrinkles right out of their skins. They no longer looked like grubs. But still their eyes were sealed fast shut, and all their world was dark, and soft, and warm. What was there to do but eat and sleep?

And then, when the little squirrels were just four weeks old, their eyes opened, not wide and round, but gently 'til a new world grew less strange. They saw their mother, and they saw one another. They were no longer fumbling in darkness.

They saw their own fur and they washed it — the smooth mouse-gray fur on their sides, and the downy white fur on their stomachs. They had to sit on their tails to do that.

They spied bits of seeds their mother had left uneaten and, balancing shakily, nibbled them with teeth no bigger than pin points.



Where did their mother go when she climbed up over their heads and left them? They dug in their sharp little nails, and jerkily scrambled up to see. But no matter how hard they squeezed, only two could look out of the hole at the same time.

One night the boldest crept all the way out. But in no time at all his mother came back and caught him. She wasn't very gentle, for she didn't want to drop him. How sharp her teeth were! How they pinched his tender stomach! He squealed and curled up like a worm. And back into the hole she stuffed him headfirst.

Soon she couldn't keep any of them in bed after twilight, or get them back before dawn. Though she pushed them in firmly, out they popped time and again to chase one another around the tree trunk and along the branches, both big and little. If they ever sat still to rest, they were soon up again and away in a twinkling.

And their mother kept a sharp watch for owls.

Below on the floor of the woods the ferns were uncurling until their fronds stood tall and wide and flat. And lady slippers hung from their stems like small pink balloons.

Soon the little squirrels were beginning to fly. Of course it wasn't *really* flying, because they had no wings to flap.

First they hopped a few inches. Then they gathered their courage and their legs and hopped a bit farther.

At last they grew bold. They sprang into the air, spread their legs so wide that the sails stretched tightly between them, and *swooped* down to a branch.

Their mother glided from one tree to another, steering with her flat tail like a rudder, but they dared sail only from branch to branch.

By now it was summer, and the young squirrels were almost as big as their mother. Now when daylight was fading, it was no longer the peepers who sang in the pond, but frogs with voices that boomed. And the long, warm dusk was sweet with the singing of thrushes.

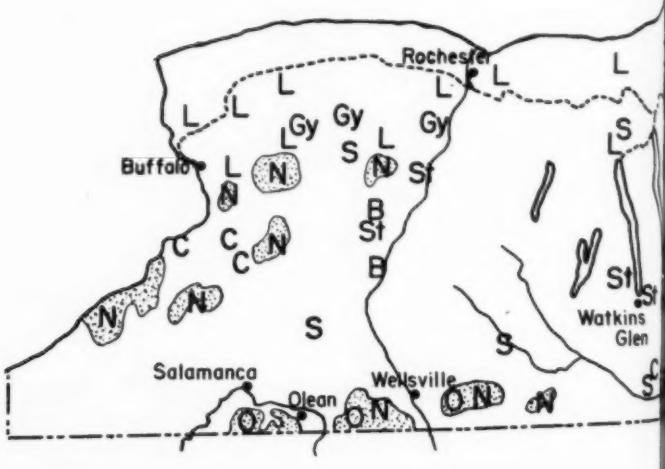
One little squirrel opened her mouth, her ears rose high on her head, her whiskers shot forward, and " Eeeeeeee — eeeeee," she sang too, with a sound like the long-drawn peep of a very small bird.

From the next branch her brother answered. Then they both sang together, " Br-r-r-r-r-r-r — br-r-r-r-r-r-r," " Eeeeeeeep — eeeeeeep — eeeeeeeep."

Darkness soon stilled the thrushes' singing. But under their tent of leaves through which the bright stars shone, the four little squirrels and their mother, now silent as shadows, ran and flew until dawn.

Minerals Are Nonrenewable Resources

Man can not grow a coal mine by planting a lump of coal. Unlike plant and animal resources, mineral resources are nonrenewable and sometimes occur only in very limited amounts. It is vitally important to national and world economy that they be used wisely for the benefit of all mankind. Conservation measures which may be applied include improved mining methods to reduce waste and make it possible to work lower grade ores, development of by-products, use of substitutes for the rarer minerals, wise use of the finished products by consumers and, finally, effective methods of salvaging.



MINERAL RESOURCES OF NEW YO

Only active mining, quarrying and well operations are shown on this map. In 1950, New York ranked ninth in the country in the variety of its mineral products and nineteenth in terms of annual mineral production value ($200,000,000).

Metallics. The most important metallic ores are those of iron, zinc and titanium. Until the discovery of the vast Mesabi iron deposits of Minnesota, New York ranked high as an iron-producing state. Now again it is the State's leading mineral resource in terms of value. The largest titanium mine in the world at present has recently been developed at Tahawus. Lead and a small amount of silver are obtained as by-products of the zinc mining. No gold mining has ever been carried on.

Nonmetallics. T cou
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clay, sand and gra mos
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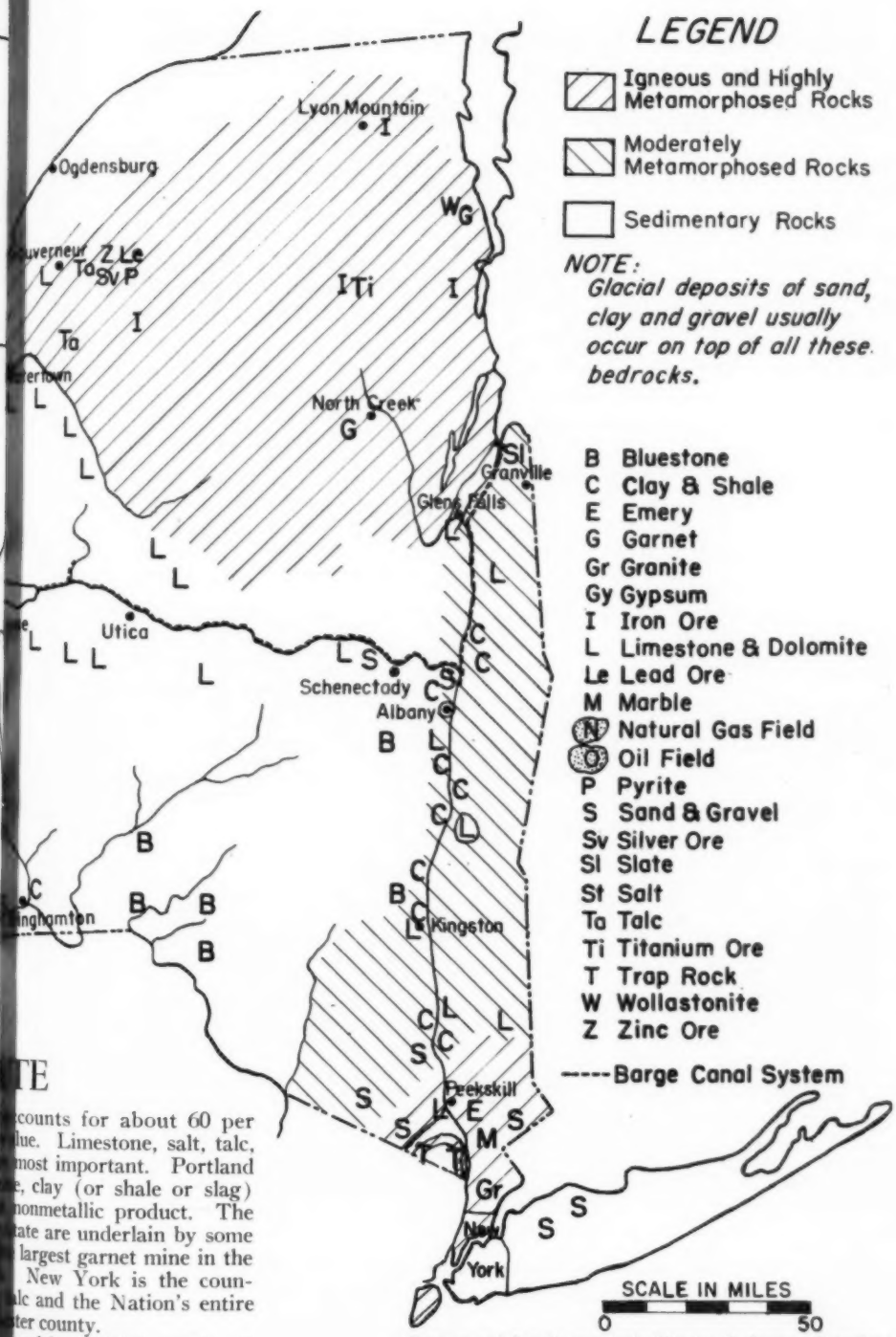

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Conservation through Earth Science

Pupils Learn Basic Conservation Principles from Earth Science Projects

MADELEINE FRINK COUTANT
Assistant in Secondary Curriculum
Bureau of Secondary Curriculum Development
State Education Department

ALL PLANTS AND ANIMALS DEPEND upon soil and water. The nature and abundance of soil and water depend in turn upon the character of the surface of the earth and the climatic conditions of each region. In earth science, pupils have the opportunity to become acquainted with the outstanding geologic characteristics of their region, to see how soil is formed, to find where water is obtained and to learn how both soil and water can be managed so that harmony may be maintained between man and the land.

Learning is based on firsthand observation of the earth's surface by means of field trips to various parts of the school district. Pupils first locate the relatively permanent geologic features by direct observation with the aid of topographic maps and reference books. Such features include the mountains, valleys, glacial deposits and the principal kinds of soil. Resources such as metallic ores, nonmetallics and fuels are disclosed by mines, oil wells and quarries. The drainage system in the area is then discovered through observation of rivers, lakes, streams, wells, springs and the water in the soil. The composition and tilt of layers of soil and rock are noted as they appear in exposures of the earth's crust along roadcuts and stream banks and in the excavations for cellars of new homes. The weather for the area is studied also, because temperature and rainfall play a vital part in sculpturing the land.

Many of these features can not be replaced by man. For example, the supply of mineral resources is limited and not renewable. The accompanying map indicates the active mining and quarrying operations in New York State. Metallics, nonmetallics and fuels are shown at locations where they are present in high enough concentrations for commercial use at the present time. With the aid of such information, pupils make special studies of critical mineral resources and where they are found. They learn about improved mining methods to reduce waste and to use lower grade ores. They investigate new uses for by-products, the use of substitutes for the rarer minerals, the wise use of finished products and effective methods of salvaging.

Conditions over which man has more control are also noted. Natural erosion has usually created the face of the land as we see it today, but man's activities have often increased the rate and extent of the natural process. Successive field trips to the same places bring out the fact that the land is undergoing continuous change. Pupils note examples of eroding cropland, gullied pastures and lawns, undercut stream banks and changing shorelines. Then they study man's effectiveness in controlling these conditions. Simple, controlled experiments are often carried on by pupils in

class to demonstrate how erosion takes place and how it can be reduced.

Soil samples from selected fields and woodlands are examined in detail. Excavations of about one cubic foot each are made in order to expose profiles of the soil and subsoil. The soil is then examined for texture, stoniness, acidity, mottling and structure. The slope of the land is measured. The findings are interpreted and the total information gathered affords a good basis for judging the land and classifying it as:

1 Land suitable for cultivation
2 Grazing land that must never be plowed
3 Forest land for producing timber and protecting watersheds
4 Land unsuitable for forestry, but satisfactory for wildlife (marshes, brushland)

The water conditions are investigated also. Pupils locate the sources of water supply for farms, industries, water power and irrigation as well as for drinking purposes. They check the depths of wells at different times of the year and from the figures obtained they estimate the changing position of the water table. They study all dams and reservoirs in the neighborhood in relation to the purposes they are designed to serve. Groups of pupils build small dams of the type needed to control the water in streams. When streams are not accessible, model dams are built in the classroom.

Many of the essential facts and principles of conservation are gained from an intensive study of a small piece of land. The school grounds often make a good laboratory for this purpose, or permission

Photograph by Nevins
Courtesy of the Reporter Dispatch, White Plains

Firsthand Observation of Earth's Surface during a Field Trip

Photograph by Gordon Webb
Courtesy of U. S. Soil Conservation Service

Helping To Control Erosion in Their Community

is requested to use parks or private land. Pupils examine and compare six-inch cubes of soil from different places, determine the water content and penetration and note what plants and animals live in and on each particular soil.

Practice is given in mapping these small areas as a foundation for the later study of the topographic map of the quadrangle that includes the school district. Maps made from old and new surveys are compared to see if any changes in topography have taken place in the intervening years. Pupils from farms make maps of their own farms and procure aerial photographs of them from their Soil Conservation District.

Having explored the existing conditions and classified the land in their locality, pupils suggest methods for maintaining productivity and reducing erosion. These recommendations may include cover crops, rotated crops, contour plowing, strip cropping, terracing, fertilizing, reforestation and managing water and wildlife. Relief maps are constructed to show how the area will look after the suggested improvements have been made. Pupils find out how these improvements are actually accomplished by learning how to measure slope, stake out contour lines, plant trees, treat acid soil and manage small streams. In many cases the pupils publicize conservation measures that they feel are needed in the community, and assist in carrying them out.

Finally, as a culmination of the instruction, pupils gain a broad concept of the changing earth. They learn what they and other citizens must do to use its resources wisely and thus conserve its values for future generations.

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Conservation Education for Teachers

Some Aids to Planning a Successful Conservation Workshop

LEE J. BURLAND
Science Teacher
Columbia High School
East Greenbush

CONSERVATION IS A SUBJECT WHICH everyone unanimously concedes to be of vital importance, but which often finds people reluctant to take definite action. A group of public school personnel in southern Rensselaer county has gone beyond this head-nodding stage. On October 18, 1953, this group concluded the second of two successful week-end workshop programs. The first was held June 5th–7th and the second October 15th–18th, each attended by 40 to 50 teachers representing 14 different school systems.

Photograph by James F. Hargrave

Putting the "Work" into Workshop—
Teachers Constructing Terrariums

Popular demand from those who have attended seems to point toward continuance of such a program, and a third workshop is being planned for late spring.

The spark which kindled these week ends was the participation of a few Rensselaer County teachers in the Arnot Forest workshops, which are jointly sponsored by Cornell University and the New York State Conservation Council. As a result of Mrs Margaret Minch's report of the Arnot workshop, Superintendent Herford Smith of East Greenbush assembled a committee of ten persons which has since organized and sponsored two week-end workshops.

Workshops can contribute significantly to those who come with a specific interest and a desire to devote time and energy to the observation, examination and discussion of facts related to that interest. In these workshops we are chiefly concerned with improving and extending conservation education. Contacts with a staff of consultants can renew and revise a teacher's thinking on conservation; consultants can provide new ideas, techniques and trends of thought applicable to classroom situations. Actual outdoor experiences can increase knowledge and deepen appreciation of natural resources.

The personal values which accrue to participants through the social experiences provided by a week-end camp situation are recognized. The programs included time for square dancing, periods of free time for informal discussion, movies, slides and midnight snacks; time was provided for religious worship conducted at the camp by members of the workshop.

Our planning committee is composed of two district superintendents, two principals and six classroom teachers. We believe it is a desirable policy to have this committee include both teachers and administrators. In many instances the administrators are better fitted by training and experience to foresee and solve problems which might prove stumbling blocks for teachers alone. They are apt to have a wider sphere of contacts and sources of information which may prove essential in the formulation of policy or plans. It should be noted that through the efforts of the superintendents, teachers who attended the workshop could earn in-service training credit.

To provide adequate time for the type of program we had decided upon, it was necessary to use a complete week end. By permission of our local superintendents and principals, we scheduled the second project on the week end of the Eastern Zone conference of the New York State Teachers Association, which permitted us to open on Thursday evening and close on Sunday afternoon. We were fortunate in having the use of the Rensselaer County 4-H Camp, which is centrally located at Alps. This camp has accommodations for about 150 persons. We believe it is desirable to select a location which is easily accessible and not too primitive in accommodations, yet

which is completely removed from the school environment.

The committee has a number of ideas for future week ends. Previous programs have been generalized, perhaps too much so. It is feasible that other programs could be devoted to the exploration of single phases of conservation, such as, soil, water, forests, minerals etc. Another idea is that some future program may incorporate a group of pupils in the general round of activities. Still another suggestion has been a week end devoted to a tour type of program in which the group moves from one locale to another for specific items of interest. For the more rugged individuals it has been suggested that something in the nature of a survival course could be held to demonstrate methods of adjusting to emergency situations.

The program offered at the workshops included three specific types of activity — field experiences, work experiences and lecture-demonstrations. Except for the latter, the participants were separated into groups of 12 or 14. This division into groups was a procedure which contributed significantly to the success and value of the workshops. Each group was scheduled to meet the various consultants on a rotating period basis throughout the day. The consultants dealt with a wide range of conservation ideas and theory — soils, water, wildlife, contour maps, forestry and ecology. In the evenings for approximately an hour and a half one or two speakers met with the entire group. Members of the consultant staff were chosen for their competence in conservation and familiarity with teaching. They were not expected to solve specific problems but rather to help the participants arrive at their own solutions.

Photograph by James F. Hargrave

Dr Theodore Eckert (seated) of Cornell University Directing a Workshop Group in Map Making

At the second workshop we attempted to put the "work" in workshop into actual practice. Each small group was scheduled to a three-hour block of time during which all persons in the group had the opportunity to construct and stock a terrarium. The necessary materials were supplied by the committee at a nominal cost; soil and plants were gathered from the surrounding woods and nelds. In addition many of the teachers constructed dioramas which illustrated a variety of natural habitats. In the event that anyone had more than sufficient time for these projects, the committee made available a large number of films and filmstrips which could be previewed for possible classroom use. This type of activity proved extremely popular with all.

The success of these workshops has depended upon the splendid cooperation and support given by numerous organizations and individuals. Outstanding among these was the Rensselaer County 4-H. Not only were these people willing to rent us their camp, but they were effective in securing valuable staff members from such places as the extension service at Cornell University and the Conservation Department. County Agent for the 4-H, V. Joseph McAuliffe, was especially helpful. We also received invaluable help from the State College for Teachers at Albany, the State Teachers Colleges at Oneonta and Cortland, the State Education Department, the Division of Nature, Science, and Conservation Education at Cornell University, Rensselaer Polytechnic Institute, the Soil Conservation Service, the New York State Conservation Department, the State Museum at Albany and the Columbia High School Library. The sincere interest and unhesitating willingness to provide substantial aid has been most encouraging.

In organizing our programs, we were faced with two problems which required considerable deliberation. One was the financing of such a project. This was finally accomplished by assessing each participant a fee sufficient to cover the tood and costs of operating the camp. We were fortunate that the consultants were willing to serve with no remuneration other than food and lodging; in some instances where a consultant traveled a considerable distance, we tried to defray the travel costs. The fee for the first week end was $12; for the second, it was $16. We were able to break even on each one. It is certainly significant that some 50 persons were sufficiently concerned with the problem of conservation education to meet the necessary assessment.

The second problem had to do with the scheduling of the staff consultants who were unable to be at the camp during the entire workshop period. In some cases we asked the consultant to be with us in the evening for the after-supper session, when he spoke to the entire group; in other instances schedule adjustment involved leaving a consultant with one or two free periods; in some cases where there was no other alternative it was necessary to increase the size of the group assigned to the consultant for field experiences.

There is much work involved in planning and presenting workshop week ends of this nature; nevertheless, the benefits, inspirations and experiences are worth the effort invested. Don't be afraid to start such a workshop. You will be surprised at the number of persons in your own area who are genuinely concerned with this problem of conservation education. Create an opportunity for your teachers to develop sound attitudes and sincere interests in presenting conservation to the young people of your community. Man can not create a substitute for nature; he must learn to cooperate with it. Here is a beginning point for such learning.

Eager Beavers

A Special Project for Your Third or Fourth Grade

CATHARINE A. WITHERELL
Museum Instructor
New York State Museum

Photographs by the author and John Heller, State Museum photographer

TO MAKE A MODEL IN THE CLASSROOM of a beaver house and dam is a relatively simple and rewarding project for children in either the third or fourth grades and can be accomplished in about six half-hour periods by adapting these general instructions to individual schoolroom conditions.

The finished project will provide a realistic conception of the construction work for which the beaver is so famous and will even explain the mysteries of the interior of the house and its underwater entrance. Much general information about other woodland animals will also be absorbed by the children.

Read aloud to the class "Paddy the Beaver" or some similar story which gives an accurate account of the ways of beavers and of other small woodland animals commonly found in the area surrounding a beaver pond. Stress the differences between the real nature facts and the story element. Once they catch on, the children will volunteer "science" and "story" as they listen and will recall the natural history material as they make the models later.

Before starting actual work on the project, divide the class into committees such as landscapers, plaster workers, painters, stick gatherers, sawers and whittlers, and clay modelers. The last two groups can be large and flexible and will take care of everyone who is not working in necessarily small groups on special features.

NOTE. The accompanying illustrations were taken through the cooperation of the Willard Day School in Troy, where this project has been repeated several times by different teachers.

Photograph by Author

1 ***Make pond and stream.*** **Cover work table or other surface with newspapers. Fifteen inches from end of table, support 4′ x 4′ pond-board on rocks. Make this about 4″ high.**

Make stream by laying sheets of drawing paper from edge of pond to other end of work table. Paint drawing paper ice blue or, for a more realistic effect, paint deep blue and cover with transparent paper.

2 ***Prepare beaver sticks.*** **Have sawers and whittlers committee prepare small branches and large twigs to resemble gnawed beaver sticks. Use these to make house and dam.**

Materials Required

Table or work area (about 4′ x 8′ or 4′ x 12′)
Stiff wallboard or heavy cardboard 4′ x 4′ (for the pond)
Round-bottomed bowl 7″ or 8″ in diameter (for top of house)
Cotton batting, 1 roll
Plaster of Paris (or salt and flour dough)
Sticks and twigs
Evergreen boughs, 1′–2′ long
Rocks
Sand (or sawdust)
White drawing paper
Transparent paper (optional)
Paints (water color)
Artificial snow
Modeling clay (old mixed-up colors)
Old white candles
Old newspapers
Thumbtacks

3 ***Make top of beaver house.*** **Cover bowl with thick layer of plaster of Paris. Before plaster sets, quickly arrange many small "beaver sticks" crisscross over it. Paint plaster dark brown to look like mud where it shows between sticks.**

4 *Make base of beaver house.* Cut a round hole in pond-board, making diameter slightly less than that of bowl. With board removed, use more sticks and plaster and brown paint to build base of beaver house on newspapers directly below where hole will be. Leave entrance hole for beavers on one side of project near bottom.

Replace pond-board on rock supports and set top of beaver house over hole. Cover surface of pond with painted blue paper resembling ice.

Photograph by Author

5 *Model animals.* Have clay modelers committee fashion beavers in various positions, as well as other animals mentioned in story. A human figure or two might be included. Use pictures for accuracy of detail.

Encourage children to look carefully and to copy as faithfully as possible. Many natural history facts about the beaver and other animals can be learned during this process.

6 *Paint animals.* Dip modeled animals into *very thin* mixture of plaster of Paris so that they will be only lightly coated. When dry, paint them appropriately. To bring in the subject of conservation one class had a "Farmer Brown's boy" investigating a trap line.

7 *Build dam.* Where pond overlaps stream, build dam with small sticks, twigs and plaster (or real mud) according to description in "Paddy the Beaver" or other source books. Paint white parts brown. (See illustration at beginning of article.)

8 *Landscape.* Using damp sand and rocks, landscape edges of pond. Leave opening on one side so that entrance hole in base of beaver house may be seen below surface of pond.

There can be many variations in the development of the landscaping, according to the ingenuity of the group and classroom facilities. If work space is in a corner, slope sand and rocks to make higher ground in corner. Rocks may be piled to make a waterfall. Candle wax may be dripped over rocks to look like ice. A large background painting of pond and woods may be made by the children.

Using wadded-up newspaper and cotton batting, make irregular snow banks on both sides of stream, blending into sand and rock landscaping at ends of dam and tapering off at other end of stream. Stand tips of assorted evergreen boughs against back wall to form a thick cover behind pond and stream. Stick small evergreen sprigs into snow banks on near side of stream. Place bare branch tips (with twigs) in sand around pond to represent aspen, birch and willow trees which beavers use.

Arrange beavers inside house, swimming around under water near entrance, or working around edges of pond. Put other animals in suitable places. The final step is to sprinkle with artificial snow.

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Tent Caterpillar Outbreak

Nearly 7,500,000 Acres of Forest Damaged in the State

DONALD P. CONNOLA
Senior Entomologist
New York State Science Service

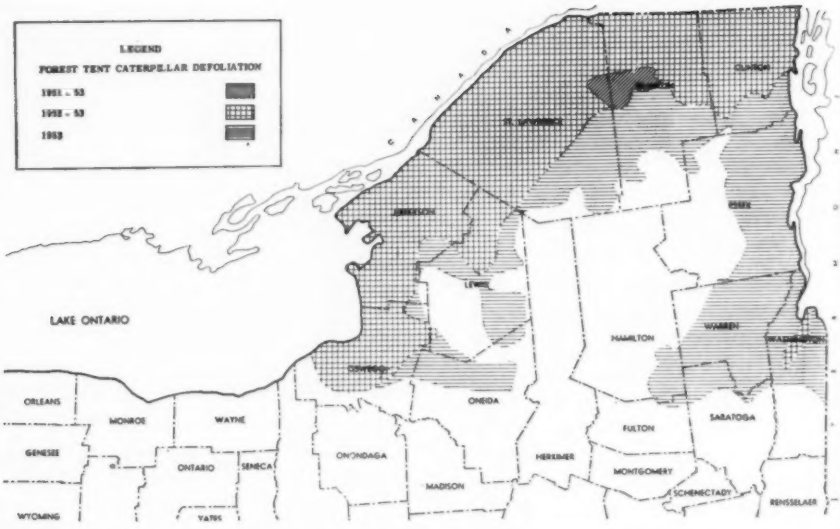
MOST OF US ARE FAMILIAR WITH THE ravages of tent caterpillars. We see their ugly nests, or "tents," in trees — particularly apple and cherry — in the spring and watch the caterpillars voraciously devouring the foliage until nothing but the bare tree remains.

There are several species of tent caterpillars in the United States. The one commonly noticed in New York is the eastern tent caterpillar, *Malacosoma americanum*. We also have a closely related species called the forest tent caterpillar, *Malacosoma disstria*, which feeds on the foliage of practically all deciduous forest trees except red maple, and also feeds on apple and cherry. These tent caterpillars do not make a true tent like that of the eastern tent caterpillar but rather a silken mat on the trunk or large branches of trees. Both species are gregarious. They feed during the day when weather conditions are favorable and return to their tents to rest or molt, enlarging the tents as they grow.

Both species are native insects and occur throughout the State, often in the same locality. In most years the damage by the caterpillars is inconsequential, but when favorable conditions occur in nature which allow the insects to multiply in large numbers, an "outbreak" occurs. An outbreak was recorded from Massachusetts as early as 1646. Recorded outbreaks of forest tent caterpillars occurred in New York in 1857, 1887–89, 1897–1901, 1924 and 1935–40. We are now experiencing another outbreak which began in 1951, when foliage on 110,000 acres of forest land was damaged or destroyed in the vicinity of Lake Ozonia in St Lawrence and Franklin counties in northern New York. In 1952, the area involved increased to almost 4,000,000 acres and by 1953 the figure had reached 7,500,000 acres, as shown on the accompanying map.

The extent of defoliation on these thousands of acres of woodlands can be appreciated only by those who have seen it. Although the damage appears only temporary, permanent damage, which may be less conspicuous, can occur from repeated defoliation. Most deciduous trees can not endure more than three years of complete defoliation before showing ill effects or dying. Damage to foliage not only interferes with the growth of a tree but lowers its vigor and makes it more vulnerable to diseases and attacks by various insects.

In northern New York, the sugar maple, poplars and wild cherries have been most severely defoliated by forest tent caterpillars. Farther south, the oaks as well are a favorite host. The defoliation of sugar maple has serious consequences in many areas because of the tree's commercial value. Much sugar maple is logged in New York for making furniture, but the more immediate effect is felt in the maple syrup industry. New York is second only to Vermont in maple syrup and sugar production. The defoliation of sugar maple orchards results in decreased yield of sugar and poor quality



Areas in New York Damaged by Forest Tent Caterpillars during the Present Outbreak

syrup. Besides this loss, the trees are often attacked by the sugar maple borer which takes advantage of their weakened condition after defoliation, and mines beneath the bark and in the wood. This affects their vigor and weakens them permanently.

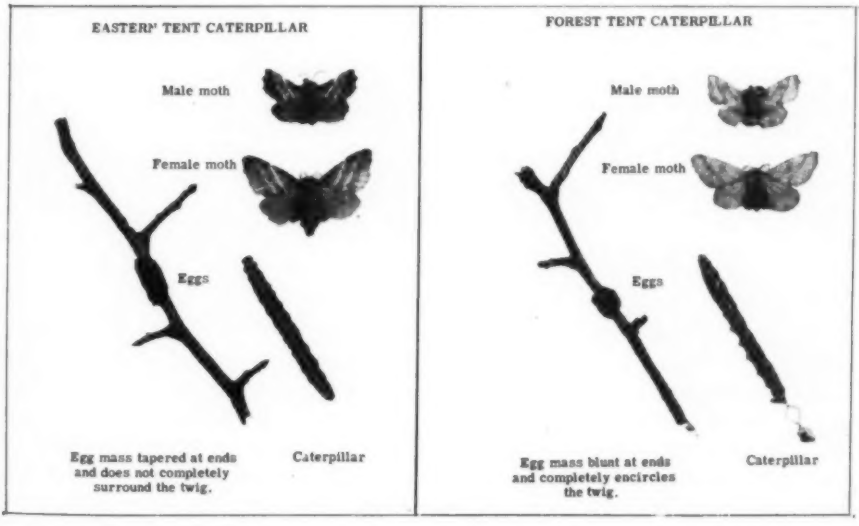
During the 1953 defoliation in New York, there seemed to be almost as much damage to foliage in some areas by the eastern tent caterpillar as by the forest tent caterpillar. Although preferring apple and cherry trees, the eastern tent caterpillar does not restrict itself to them. It also feeds on the foliage of peach, pear, plum, hawthorn, rose, and at times even on some of the deciduous forest and shade trees when the supply of favorite foliage is exhausted. In places, as along railroad rights of way, where trees have been cut and the land burned, the vegetation which follows often includes a high percentage of wild cherries. These trees provide sufficient foliage to support for a time large populations of eastern tent caterpillars. Then, as the food is exhausted, the caterpillars begin to migrate in search of a new supply and in doing so they sometimes cross railroad tracks in large numbers. Trains may be delayed or even stopped when they attempt to run through large masses of these caterpillars whose crushed bodies make the rails very slippery. This happened last year in Pitcairn in St Lawrence county.

Defoliation by tent caterpillars ceases in June when they complete their feeding and are ready to pupate. They are then about two inches long. The two species are both dark colored and sparsely covered with light brown hairs but differ in markings. The eastern tent caterpillar has a longitudinal row of pale blue dots surrounded by black along each side, one dot on each segment, and a longitudinal white stripe down its back. The forest tent caterpillar has a pale blue longitudinal stripe on each side and a longitudinal row of keyhole-shaped white spots along its back, one on each segment.

The full grown caterpillars seek a sheltered spot in a crack or crevice, where they spin a cocoon and pupate. Forest tent caterpillars commonly spin their cocoons in folded leaves. The pupae are dark brown or mahogany colored. In July the moths emerge. The male moth has a wing span of about one inch; the female about one inch and a half. Both species of moths are somewhat hairy and are light colored. The eastern tent caterpillar moth is tan with two oblique white stripes near the center of each forewing. The forest tent caterpillar moth is a light buff with two oblique tan stripes near the center of each forewing. The moths mate shortly after emergence and lay their eggs during July or early August.

The activities of the eastern tent caterpillar may begin slightly earlier than those of its close relative. The eggs are laid in masses on twigs of host trees. They are cemented together side by side around the twig, and are covered with a varnish-like substance called spumaline which gives them a shiny molasses-like color and protects them from dehydration. The forest tent caterpillar egg mass is cylindrical or ringlike in shape and squared at the ends. The eastern tent caterpillar egg mass is usually longer, oval in shape with rounded edges and often attached more to one side of the twig. There is an average of 150 eggs in one egg mass which may be a half-inch to an inch in length and a quarter-inch in diameter.

The eggs hatch two or three weeks after being laid, but the young larvae remain in the eggs until the following spring. They may be seen if the spumaline is scraped off and the tops of the egg cells are removed with a needle. If the egg masses are brought into room temperature late in the winter or early spring, the larvae will emerge in one or more days. The small newly hatched larvae are dark with light hairs. Their characteristic markings appear after they molt the second time. Immediately after emerging from the egg cluster, the larvae remain grouped



Comparison of the Different Stages of Eastern and Forest Tent Caterpillars

together on the egg mass for a day or so before migrating in search of food. Emergence of the tiny caterpillars out of doors usually occurs at the time the buds are bursting.

In periods of outbreak, considerable control has been obtained in many communities by the organized efforts of school classes or clubs in collecting and burning egg masses during the winter and early spring months before the caterpillars emerge. It is difficult to determine far in advance just when an outbreak will occur, but with careful vigilance, it is relatively easy to detect an incipient outbreak by field observations of the numbers of egg masses occurring on the trees. The New York State Science Service of the State Education Department, in cooperation with the Bureau of Forest Pest Control of the State Conservation Department, makes egg mass surveys in the sugar maple orchards and woodlands of the State to forecast the extent of defoliation expected the following season.

In the winter of 1952–53, the method was used in an effort to determine the sugar maple orchards which would be heavily defoliated in the spring. This provided the necessary information for the spraying program which followed and prevented much of the defoliation. State Conservation Department airplanes sprayed 18,000 acres of sugar maple with DDT provided by the counties. Only a half pound of DDT per acre was necessary to kill the caterpillars. This program illustrates what can be done to minimize damage when early predictions of insect attack can be made.

It is not so easy to predict how long an outbreak will last. In New York, outbreaks have been known to last from one to six years. Much depends on the natural factors which work against the survival of the tent caterpillars. These include climatic conditions such as extremely hot summer temperatures during the egg-laying period, which may kill many of the eggs, or late frosts in the spring, which may kill many of the newly emerged caterpillars. Another factor is starvation, which often occurs when there are so many caterpillars in an area that there is insufficient food.

A third and probably most important factor is that of natural enemies. Almost 50 species of birds are known to feed on tent caterpillars, consuming thousands each year. Some birds attack the caterpillar tents and can consume as many as 50 caterpillars in one feeding. Some also gather the webbing from caterpillar tents when building their nests. Toads have been observed to feed on tent caterpillars migrating along the ground. *Calosoma* beetles, on the other hand, actually climb trees to prey on them.

Another enemy is disease. Tent caterpillars are subject to a bacterial disease called the wilt disease, which often destroys enormous numbers of them. The eggs, larvae and pupae are often attacked by parasitic insects which do much to keep the caterpillars in check. One such insect is a flesh fly, *Sarcophaga aldrichi,* which looks somewhat like a large house fly. The adult fly lays its eggs on full grown caterpillars or pupae and the hatched maggot enters the body of the developing tent caterpillar and destroys it. Some authorities believe this parasite is chiefly responsible for the final decline of tent caterpillars, but it takes time for the parasite populations to build up to the point where they destroy large numbers of them.

With the decline of the caterpillars, the parasite populations decline also. There are always a few tent caterpillars, however, which escape destruction. These remain in endemic numbers to rise again when conditions are favorable for another outbreak.

The "Ups and Downs" of Mammals

Fluctuation in Animal Numbers a Basic Phenomenon of Nature

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IT IS COMMONLY OBSERVED THAT THERE are more animals of certain kinds in the fields and woods some years than others. A walk through the autumn woods is made memorable in some years by the abundance of frolicking squirrels or the number of cottontails that flash away at our approach. In indirect ways, also, we become aware of the unusual abundance of other kinds of mammals. Repeated items in the newspapers may tell us that the fox population is high when numerous rabid animals enter the farmyards or infect the cattle in pastures. The fruit grower becomes aware of high populations of meadow mice when the melting snow of spring reveals his neatly debarked trees standing naked in rows.

In contrast to years of high populations there are years when the woods seem empty of mammals. The teeming mice seem to have vanished from the meadows and the stealthy fox looks for other prey and fills the empty niches of his stomach with frozen apples. This is not to imply that the fluctuations in abundance of different kinds of mammals always coincide, but often they appear to do so.

Most often in discussing mammal fluctuations we hear of the hordes of uncountable lemmings that appear periodically in the hills of Norway and eventually flow in a vast stream of life over valleys, rivers and plains to vanish at last into the sea. Or perhaps we read of snowshoe hares occurring in incredible numbers at intervals of about ten years in the northern forests, only to disappear, at last, like the snows of winter, leaving an empty forest behind them. While it is true that the fluctuations of these mammals have been studied the most, all of us can observe similar phenomena on a less dramatic scale in our familiar animals.

What significance do these fluctuations have in the intricate web of life that exists in nature? Not many answers are clearly known but some of the more obvious effects can be seen. Through the study of Hudson Bay fur returns over a period of many years, biologists have noted that the abundance of the lynx seems to be keyed to the abundance of the snowshoe hare that is its principal item of diet. The peaks in lynx abundance seemingly occur a year or two after those of the hare, and with the same degree of regularity. Regular fluctuations that exhibit a definite periodicity are often referred to as "cyclic." Whether these periodic cycles result definitely from precise cause and effect or are merely fortuitous random fluctuations is a debatable point among some ecologists.

It is believed by some that the appearance of the magnificent snowy owl in large numbers in the United States every three or four years is connected with the periodic "crash" of the lemming and mouse populations in the northern tundra regions.

Melting Snow Reveals Debarked Orchard Trees Indicating High Meadow Mouse Population

When our own mouse populations are high, meadow mice are the staple item in the winter diet of the fox. When the mice become scarce the fox looks elsewhere for his prey and may take more rabbits or other game. We must be careful, however, in pursuing our example further. It is not at all certain that the increased predation by the fox on rabbits or other game has any direct effect on their subsequent numbers. Some studies have shown that there may be compensating factors at work so that we end up with about as many rabbits at the end of the next breeding season. If there are fewer rabbits there may be less disease transmission, and in less dense populations there may be increased litter survival. Studies of muskrats, for example, have shown that there is usually less internal strife in uncrowded populations and a larger proportion of young muskrats may reach maturity than is the case in crowded populations.

The effects of mammal fluctuations on natural vegetation may be very great and this, in turn, may seriously affect other animals. An abundance of beaver, for example, may result in many dams that flood areas of stream valleys and eliminate portions of suitable wintering areas for deer. These may be critical areas of shrubs and hardwoods in an otherwise largely coniferous forest. Since most conifers are poor food for deer, winter starvation losses may occur when deep snows restrict deer movement to other areas. On the other hand, when old beaver ponds are drained or filled through natural processes, the old bottom makes a fertile site for a resurgence of vegetation that is highly attractive to deer and other wildlife and provides them with an excellent food supply for a time.

Large numbers of cottontails in hardwood forests may seriously depress the growth of the understory of shrubs and saplings and thus restrict the amount of food available for such animals as deer. The deer themselves, when abundant, may so change the vegetational complex through excessive browsing that the area becomes unsuitable for many kinds of game, including the deer.

When meadow mice reach population "highs" they may remove the bark from a high proportion of the shrubs in some game coverts and thus reduce the carrying capacity of the area for game. The effects of excessive mouse numbers on the vegetation of old fields is more subtle, but possibly important to other animals.

With high squirrel numbers in recent years there have been increasing reports of squirrel damage to trees. The squirrels seem to be feeding rather extensively on the bark of trees, sometimes removing it from entire branches and sometimes girdling the top branches of large trees in amazingly geometric spirals that look as though some boy had been busy with a jackknife.

When cotton rats reach a population peak in southern states, they may become serious enemies of quail by competing with them for available food. In addition they affect the quail directly by eating eggs and young. Other ground-nesting birds may be affected also.

Man himself, of course, is a mammal whose density affects other mammals in exceedingly far-reaching ways. As the human population has grown in our country, there have been vast and varied changes in the face of the land. These changes and the direct activities of man have resulted in the virtual elimination of such mammals as the bison. Such magnificent predators as the wolf and mountain lion have been removed from most of their former habitat. On the other hand, the changes man has made have resulted in increased habitat for some kinds of mammals. A little protection and manipulation have resulted in embarrassingly large numbers of beaver and deer in some areas. The cutting of mature forests and the cultivation of the land have been boons to some animals, providing them with increased habitat, while such activities have spelled disaster to other animals, such as the lynx.

The fluctuation of mammal numbers has numerous direct economic effects on man. Some of these have already been hinted at above. As a further example we may consider the rise in fox numbers that occurred in the 1940's. Sporadic outbreaks of rabies in foxes and other wild animals have occurred in this country for almost 150 years. Perhaps the most extensive epizootic in foxes occurred during this last rise in fox numbers. This outbreak extended from north central New York south along the Appalachians to Georgia, westward to Texas and northward to Iowa. Large numbers of foxes were infected during this period when fox populations were estimated to be as high as 12 per square mile in some favorable habitats. Many foxes died and were not found by man and many found dead were never reported, but laboratory examinations of dead foxes showed a high incidence of rabies. During such epizootics the infection spreads to other wildlife, and raccoons, skunks and other animals may become rabid. During one three-and-a-half-year period in New York, 886 cattle, valued at a quarter of a million dollars, died of rabies. An additional unknown item was the total cost of rabies insurance or rabies innoculations. One estimate, made in 1949, placed the annual toll of rabies in the United States at five million dollars through livestock losses and the costs of treating over 30,000 persons exposed to the disease each year. Not all this can be assessed to foxes and other wild mammals, however, since domestic dogs are deeply involved.

The effects of high mammal numbers in connection with damage to crops, forest reproduction or range lands is often observed. On the positive side, high game mammal populations result in the collection of millions of dollars in sporting revenues, and high populations of fur animals may result in greatly increased income to trappers.

While the occurrence of fluctuations in mammal numbers is easily recognized, there is little information on the causes of the phenomenon. This is especially true of those mammals that seem to oscillate in more or less regular cycles. Great potential powers for increase in numbers are recognized as inherent in many mammals. Many natural checks and balances such as predation, weather, food supply and disease are known to operate in the regulation of animal numbers. But when all these factors and many others are

studied, they do not seem to provide a complete solution to the swinging pendulum of mammal populations.

Various over-all factors have been proposed to explain some of the more regular fluctuations. Such factors as climatic changes, disease epidemics and sunspot cycles have all had their champions, but little evidence in their support has stood the test of further study. Mammal fluctuations are a reality, but their fundamental causes are not completely known.

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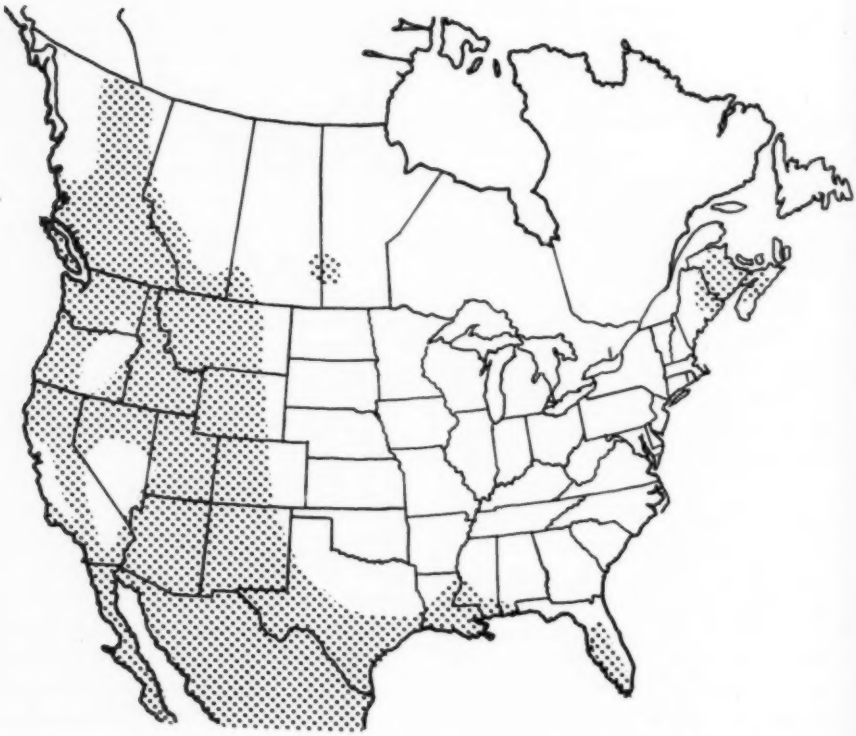

Approximate Present Known Range of the Mountain Lion from Mexico Northward

Formerly it occurred throughout much of the eastern part of the continent from the Great Lakes region southward; unconfirmed reports suggest the possibility that a few may yet be found about the Great Lakes, in upper New England and New York, and in the South Atlantic states. Part of the area in northwestern Canada has been occupied recently. In Maine and the Maritime Provinces the species has been rediscovered after decades during which it was believed to have been exterminated there.

The Mountain Lion, Our Largest Cat

(Cougar, Puma or Panther)

THIS BIG LONG-TAILED CAT has a plain coat — some shade of brownish in summer and tending more toward gray in winter. Underparts are whitish. A "mustache" mark, backs of ears and tail tip are blackish. A large male measures more than seven feet over-all, which includes a tail up to three feet long. Shoulder height ranges to 30 inches. A specimen killed in Hamilton county, New York, in 1887, is reported to have weighed 200 pounds, but very large specimens from the West may exceed this figure by up to 60 pounds. Females are about two-fifths smaller than males. Gestation requires 90–93 days and most kittens are born in spring. The litter usually contains two young, which are buffy, have darker spots and dark rings on their tails. The spotted coat is shed in six months or less. The young are reared by the mother and are believed to stay with her — at least sometimes — for as long as perhaps two years.

Commonest signs of this cat are its tracks, showing four toe-pads and, in walking gait, hindfeet are placed partly over tracks made by forefeet. In snow, the long swinging tail leaves a mark. The range of vocal sounds made is great and the subject of much folklore. Captives that I have listened to, however, usually have surprised me by making a rather weak and dry sound; had I first heard it in the woods, I should haxe expected the source to be a smaller creature and certainly not a cat. Our short-tailed cats — bobcat and lynx — tend to produce more appropriately catlike noises and they also make more meandering trails than the mountain lion. Weird noises, however, sometimes attributed to any of these species, often are found to have been produced by the barred or the great horned owl.

The mainstay of the mountain lion is deer, but it also eats other hoofed mammals and a variety of smaller creatures. The prey is carefully stalked, then the cat leaps on it from the ground, rather than springing from an overhanging rock or tree limb as commonly believed. It goes up a tree readily when pursued by dogs and puts up no defense when approached by them or the hunter. Captives thrive in zoos and breed there quite readily.

The mountain lion occurs from British Columbia to the Straits of Magellan, from Nova Scotia and Florida to Vancouver island. Not all this terrain is occupied (see map), for the species has been eliminated from much of its former habitat, including large areas in the eastern United States. In recent decades it has extended its range northward in the Rockies. This cat was thought to have been exterminated in the Northeast in the previous century, although rumors of its occurrence are frequent. Recently, knowledge that it occurs in eastern Maine, in New Brunswick and part of Nova Scotia, has been established beyond any doubt. Because of continued reports of its occurrence outside the known present range, as in northern New England, in New York, Virginia, the Carolinas and west of Lake Superior, the chances are fair that some of these reports are based on valid claims.

Authentic New York State mountain lion specimens in museums consist of a few skulls plus several poorly preserved mounted specimens — all taken at least 80 years ago. New York paid a bounty of $20 each on 99 mountain lions in the period 1871–94; others were killed in this period and not presented for bounty. It is unfortunate that some of these specimens were not saved.

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